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# The Effect of Population Upon Ability to Support Education

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for

THE BUREAU OF COÖPERATIVE RESEARCH
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# The Effect of Population upon Ability to Support Education

## 1. INTRODUCTION

THE cost of education has been discussed from many angles in the past few years. A rather careful survey of the literature of this discussion discloses that one of the most important elements determining school cost has received no adequate attention. It may seem quite strange that of all the factors determining the cost of education and the ability of a community to pay for it, the effect of the number of children has been most inadequately treated. The following discussion is an attempt to indicate, or to measure the importance of this factor.

It is evident that if one working man has a family of 4 children, he cannot educate them as well as another man with an equal income who has 2 children. The same thing is true of communities. Yet no one has called our attention to the fact in an adequate fashion. If in one community there are 4 adults to each school child and in another community only 1 adult to each school child, the first community will be more able to support schools than the second. To state it simply, if one community has 4 times as many children as another, it is not as able to provide an education for each child. This is not an extreme case for there are many communities that have more than 4 times as many children as other communities of the same population. Even in one state, Indiana, there are whole counties that have twice as many children per 1,000 people as other counties. To every 1,000 adults in Brown County, Indiana, there are approximately 1,000 children; to every 1,000 adults in Marion County, Indiana, there are approximately 500 children.

In one county, 1,000 adults have to support schools for 1,000 children; in another county, 1,000 adults have to supply schools for only 500 children. This alone is sufficient to show why the population question is so important in school support. The purpose of the following pages is to indicate more exactly the extent of this problem.

The writers who have seemingly recognized the existence of the problem have generally contented themselves with a mention of it. A few times there is an indication of the difficulty of combining the effect of the number of children with other factors in determining the ability of communities to support schools. As a whole, the treatment of the problem has been very meager and inadequate. As the schools must deal directly with the children, it would seem as if the effect upon school costs of an increasing number of children would be considered by those interested in education.

This neglect of the effect of population upon school costs is the more remarkable in view of the large amount of discussion of the effect of

population upon other topics. Any one of the larger libraries contains many references to the effects of population upon standards of living, food supply, war and peace, conditions of labor, international trade, and many other problems. Since 1798[1] the effect of population has been one of the storm centers of social discussion. The effect of population upon many specific problems has been much debated, and rather careful work has been done in some fields. Sentiment ranges all the way from those who fear race suicide to those who advocate birth control as the solution of most of the world's ills.

The two statements below taken from one field indicate the importance attached to the problem by writers. "The pressure of population always remains a chief cause of international disputes and wars."[2] "Under the circumstances is the supposition too far-fetched that if the differences in the density of population had been peacefully regulated before the war, war would not have broken out?"[3]

In the past few years the suggestion has come from many sources that due to the increasing cost, secondary and higher education may have to be limited. Because of a smaller number of children, California could send each child thru the university about as easily as South Carolina could send each child thru the eighth grade. Is it not possible that a more careful study of the population question would aid in providing a solution of the problem of making available advanced education for all?

## 2. PREVIOUS WORK

As mentioned, the existence of a problem in this field has been recognized by a few of those interested in financing education. In some cases it was seen that the problem was important; in a few cases some of the difficulties of dealing with it were stated. A rather careful study showed that in no case was there any real attempt to indicate even the size of the problem. The following quotations will indicate the type of attention that has been given to the problem by recognized authorities. The statements are among the best that could be found. In many of the educational surveys and other studies of school finance an excessive number of children was the real problem of school support, but it was not even mentioned.

In the Brookline Survey[4] there is a mention of one of the effects of a small number of children. "The wealth of Brookline is so great and the number of children enrolled in proportion to population is so small, that she gives the least percentage of her total town expenditures to education." "No less striking is the small number of children. Brookline is again at the extreme. No other city in either group has so small a percentage of its total population between the ages of 5 and 14, in-

[1] The date of publication of Malthus's *Essay on the Principle of Population as it Affects the Future Improvement of Society.*

[2] National Council of Public Morals for Great Britain. *Inquiry into Declining Birth Rate.* 1916.

[3] Montijn, A. *A New Principle of International Law.*

[4] Van Sickle, James H., and others. *Educational Survey of the Public Schools of Brookline, Mass.*

clusive, or below 15 years of age. Some cities have almost twice as large a proportion [of children] as Brookline."

"APPENDIX—TABLE NO. 2. BROOKLINE (MASS.) SURVEY. PERCENTAGE OF POPULATION ACCORDING TO AGE IN ALL CITIES BETWEEN 25,000 AND 31,000, 1910

| | City | 5 to 14 years | Under 15 |
|---|---|---|---|
| 1. | Hazelton, Pa. | 22.7 | 35.5 |
| 2. | Shenandoah, Pa. | 21.9 | 37.1 |
| 3. | Green Bay, Wis. | 20.6 | 32.3 |
| | (other cities omitted) | | |
| 49. | Battle Creek, Mich. | 13.9 | 12.9 |
| 50. | Pasadena, Calif. | 13.6 | 20.3 |
| 51. | Brookline, Mass. | 12.9 | 19.3" |

The author of the St. Louis Survey[5] in choosing cities to compare with St. Louis says: "They should be of the same wealth per inhabitant or per school child." It is not pointed out that per inhabitant and per school child are not equally valid measures for comparison. The survey in its discussion omits any reference to the effect that might be produced by different numbers of children.

"Cleveland, which, for the operation and maintenance of its schools, spends as much per inhabitant as the average city, and more than the average city per $1,000 of taxable wealth, spends less than the average city for each child in average daily attendance. This means that in Cleveland the ratio of school attendance to population and to wealth is exceptionally high. For the number of children attending its schools [probably means public schools], Cleveland is a small city and a poor city."[6]

"These figures have a certain significance in defining the education problem for Boise. As compared with other cities, Boise ranks high in young and middle-aged adults and low in infants and children of school age. In other words, when measured by other cities of her class, Boise has large wealth-producing power in comparison with the number of both young and old dependents. Other things being equal, the city of Boise should be able to provide for its children not average, but decidedly superior, educational advantages. If the 5 to 19 years age-group in Boise were 29.3 per cent of the total population, as is true for Austin, Texas, it is obvious that school costs for the city would be very close to one-third greater than they are at present."[7]

"*Percentage of Children.* In the percentage of children in the total population, Salt Lake City ranks high among western cities. The general characteristics of a western city are a marked preponderance of males, a small percentage of married males, and a small number of children. In these respects Salt Lake City is an exception, as it has but a small preponderance of males, a large per cent of the males are

[5] Judd, Charles H., and others. *Survey of the St. Louis Public Schools.*

[6] Ayres, Leonard P., and others. *The Cleveland School Survey*, Vol. 5, pp. 30-36.

[7] Sears, J. B., and others. *The Boise Survey*, p. 6 ff.

married, and in number of children it ranks with the markedly foreign-born manufacturing cities of the East and the cities of the South. Only one other western city, Ogden, exceeds it in percentage of children. This may be seen from the following table:

"TABLE NO. 3. PERCENTAGE OF CHILDREN IN THE TOTAL POPULATION COMPARED WITH WESTERN CITIES

| City | Percentage of Children | |
|---|---|---|
| | 5 to 15 years of age | Under 15 years of age |
| 1. Ogden, Utah | 20.0 | 32.1 |
| 2. Salt Lake City, Utah | 18.5 | 29.6 |
| (other cities omitted) | | |
| 16. Portland, Oregon | 12.0 | 18.8 |
| 17. San Francisco, Calif. | 11.9 | 18.9 |
| United States as a whole | 17.4 | 27.3 |

"Put in another way, Salt Lake City must provide 50 per cent more teachers and buildings per 1,000 of its total population than do such cities as Seattle, Portland, Sacramento, or San Francisco, and 30 per cent more than do Tacoma or Denver, to be able to maintain merely equivalent schools. This is the price the city must pay for its large families and its large excess of children."

"These two tables show Salt Lake City as of large per capita wealth, even though the number of children in the total population is large. If the city had the usual small proportion of children found in western cities, it would almost equal Pasadena, Portland, or Los Angeles in its per capita wealth. As it is, it must be classed among one of the few very rich cities of the United States."[8]

"Figure 5 reveals the great excess of population of the aggressive adult years between 25 and 45, and also the small percentage of school children of school age in Portland. In the population between 25 and 45 the preceding tables show that there must be a marked preponderance of men, many of whom have no families. Such a condition is characteristic of a new and rapidly growing community, and will inevitably change as the city grows older and its population becomes more settled.

. . . . . .

"This low percentage of children of the elementary school age in the total population has made the schools of Portland very easy to maintain. If the percentage for Portland were as high as the average for all cities in the United States (13.2 per cent) it would mean an increase of 6,000 elementary school children and consequently about 150 additional teachers and classrooms (10 to 12 buildings) to provide for the present population only. If Portland had such percentages of school children as are found in Fall River, Jersey City, or Newark, cities where the foreign-born population is large, from 450 to 500 additional teachers and classrooms (25 to 30 buildings) would be required to meet

[8] Cubberley, Ellwood P., and others. *The Salt Lake City Survey*, pp. 12-16.

the needs of a city of the present size. The very small number of children in the city has enabled Portland, and for some time to come, should enable it, to continue to provide educational advantages for its children much better than the average city can provide.'"[9]

The discussion of the effects of the age distribution of the population in the San Francisco Survey is very good. In many ways it is the best discussion of the problem to be found.

**"Age Distribution of Population**

"According to the census figures for 1910, Tables 5 and 6, Figure 2, the age distribution of the population of San Francisco shows marked peculiarities when compared with that of the United States as a whole. San Francisco has very much less than her share of children under 20 years of age, only a little more than half the average proportion of children 5 to 14 years of age, and much more than her share of adults of the productive ages of 25 to 44 years (41 per cent against 29.1 per cent).

"Comparing San Francisco in this respect with the 9 other cities of the same population class, Table 6, and Figure 3, similar discrepancies of distribution appear, although they are slightly less pronounced.

"As shown in Table 6, in the 9 cities the population from 5 to 19 years of age equals 43.1 per cent of the population from 20 to 64 years; in San Francisco, 28.7 per cent. In the 9 cities, therefore, the ratio of population of school age to population of 20 to 64 years of age is 50.1 per cent greater than in San Francisco. The importance of these facts for public education is manifest. With a much smaller proportion of children of school age than the average city and with a much larger proportion of productive adult population, the financial burden of supporting a public-school system rests much more lightly upon the people of San Francisco than elsewhere."

"FIGURE 7. NUMBER OF ADULT MALES FOR EACH 100 CHILDREN 5 TO 19 YEARS OF AGE

| | |
|---|---|
| San Francisco | 214.1 |
| Seattle | 212.8 |
| Los Angeles | 171.2 |
| Minneapolis | 144.5 |
| Washington | 132.9 |
| Cincinnati | 125.0 |
| Buffalo | 107.2 |
| Newark | 106.2 |
| Milwaukee | 105.2 |
| New Orleans | 99.1 |
| Average | 141.8 |

[9] Cubberley, Ellwood P., and others. *The Portland Survey*, pp. 100-103.

"As shown in Table 12 and Figure 7, San Francisco ranks first of the 10 cities in number of adult males for each 100 children of school age. The number in San Francisco is 50.9 per cent greater than the average for the 10 cities, and is more than twice the number reported for the lowest city."[10]

The above quotations from the school surveys indicate that there is considerable difference among cities in the per cent of the population that is of school age. The discussion in the quotations deals almost entirely with the situation in the West where the ratio of children to adults is small. It would be just as important to consider the matter in those eastern and southern cities where the ratio of children to adults is large. The people living in such cities should be brought to realize that having a large number of children they will have to make more than the usual effort in order to supply each child with educational advantages equal to other cities. The discussions quoted show that the problem has been partially realized, but only partially. No indication is given that number of children should be considered with wealth to get a composite of the effect of both upon ability to support education. The following pages present an attempt to combine these two factors into one measure of the ability to support schools. Before that is done the facts in regard to the variability of the states in the number of children will be given.

## 3. FACTS IN REGARD TO POPULATION CONDITIONS IN THE UNITED STATES[11]

A consideration of the differences in the age distribution of the population in the different states will indicate the importance of the population problem to education. Table I, below, gives the number of adults (21 and over) to each child (under 21) in each state. It indeed seems surprising, but the table shows that one state has only .86 of an adult to each child while another state has over 2 adults to each child.

[10] Bureau of Education Staff (U.S.) and others. *The Public School System of San Francisco*, p. 14.

[11] A more complete discussion of the population difference among the states will be found in a pamphlet soon to be issued by the Bureau of Coöperative Research, School of Education, Indiana University.

TABLE I.—NUMBER OF ADULTS (OVER 21) TO EACH CHILD (UNDER 21), STATES, 1920

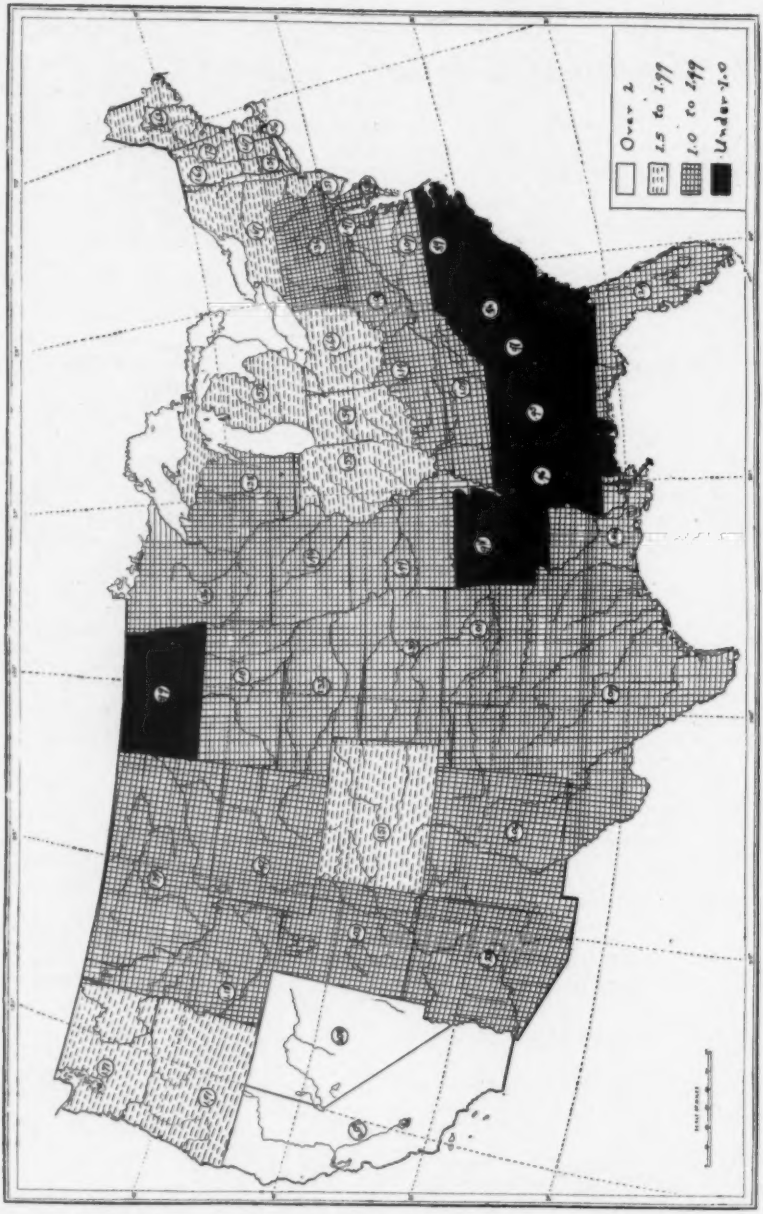
| | | | |
|---|---|---|---|
| .86 | South Carolina | 1.38 | Wisconsin |
| .89 | North Carolina | 1.39 | Montana |
| .95 | Alabama | 1.46 | Iowa |
| .96 | Mississippi | 1.47 | Wyoming |
| .97 | Georgia | 1.47 | Maryland |
| .98 | Arkansas | 1.49 | Missouri |
| .99 | North Dakota | 1.51 | New Jersey |
| 1.01 | Oklahoma | 1.51 | Colorado |
| 1.03 | Utah | 1.52 | Michigan |
| 1.06 | Louisiana | 1.54 | Indiana |
| 1.06 | New Mexico | 1.54 | Connecticut |
| 1.06 | West Virginia | 1.55 | Illinois |
| 1.08 | Tennessee | 1.56 | Rhode Island |
| 1.09 | Texas | 1.58 | Delaware |
| 1.09 | Virginia | 1.60 | Vermont |
| 1.14 | Kentucky | 1.62 | Ohio |
| 1.18 | Idaho | 1.62 | Maine |
| 1.18 | South Dakota | 1.67 | Massachusetts |
| 1.24 | Florida | 1.68 | New York |
| 1.28 | Arizona | 1.71 | Washington |
| 1.32 | Nebraska | 1.71 | Oregon |
| 1.36 | Minnesota | 1.73 | N. Hampshire |
| 1.36 | Pennsylvania | 2.08 | Nevada |
| 1.37 | Kansas | 2.09 | California |

The table is to be read as follows: South Carolina has .86 of an adult to each child, North Carolina has .89, and so on for each of the other states.

The parts of the country that have the large number of children can be located easily from the map on page 10. The black states, those having more children than adults, are some of the southern states and North Dakota. Part of the explanation for the southern states is due to the colored population. However, the birth rate among the native whites is also very high. North Dakota's position is probably due to the special type of immigrant. The sections that have the small number of children and the large number of adults are the Pacific coast, New England, and several of the highly industrialized manufacturing states of the North East and Middle West.

These very simple facts show there are large differences among the states in the ratio of adults to children. An attempt will be made to indicate more exactly the effect of these differences upon ability to furnish education for each child.

Because of the complexity of the subject, it will not be possible even to mention many of the points involved. The only points there will be time to discuss can be illustrated very nicely by one state. Therefore, the discussion will be largely confined to Indiana. The same facts are available for the other states, but lack of space prevents a discussion of them.




RATIO OF ADULTS TO CHILDREN IN EACH STATE OF THE UNITED STATES, 1920

The problem as stated is "Measuring the Effect of Population upon Ability to Support Schools". It might be more accurately stated as "The Effect upon Ability to Support Schools of Large and Small Proportions of Children".

The following discussion will be largely confined to two points: first, to show that there is a problem; second, to show some way of indicating its size or measuring it.

In order to show that there is a problem of school support in that there are varying percentages of the population of school age, the facts in regard to Indiana will be given. The state as a whole will be taken up, its position as compared with other states mentioned, the rural and urban sections within the state contrasted. The figures will be given showing the relation of the children to the total population in the counties, townships, cities, and towns of Indiana. A formula will be given, and some considerations presented to show that it measures the size of the problem fairly satisfactorily.

## 4. FACTS IN REGARD TO INDIANA

If the states of the Union are ranked in order, beginning with the one that has the smallest proportion of children and going to the one having the largest proportion of children, Indiana will be well toward the first of the list (having a small proportion of children and an easy school load).

Indiana has fewer children of school age per 1,000 people than the typical state. Only 14 states have a smaller percentage of their population of school age than Indiana. Indiana has about the same number of children per 1,000 people as the bordering states, a much smaller number than the southern and most of the central states, and a larger number than the New England or far western states. The state has a much lighter load to bear in educating all the children than most of the other states.

The basic question that is being considered throws more light upon the support of education by the different states than almost any other question that has been studied. As an illustration, because of the difference in the number of children, California would have to send each child thru the university to provide as much schooling as South Carolina would provide in sending each child thru the eight grades. Needless to say, South Carolina is probably providing more education than California.

*Rural and Urban Sections of the State.* Viewing the condition within the state, one of the most noticeable factors is the difference between the rural and urban sections. Table II shows the full extent of this difference.

TABLE II.—PER CENT OF POPULATION IN DIFFERENT AGE GROUPS, URBAN AND RURAL POPULATION OF INDIANA, 1920

| Urban Population | Per Cent | Rural Population | Per Cent |
|---|---|---|---|
| Under 5 years | 9.4 | Under 5 years | 10.4 |
| 5 to 9 years | 9.0 | 5 to 9 years | 10.5 |
| 10 to 14 years | 8.4 | 10 to 14 years | 10.4 |
| 15 to 19 years | 8.2 | 15 to 19 years | 9.1 |
| | 35.0 per cent | | 40.4 per cent |
| 20 to 44 | 41.5 | 20 to 44 | 33.2 |
| 45 and over | 23.3 | 45 and over | 26.4 |

Thirty-five per cent of the urban population is 19 years of age or less, or what might be called children, for purposes of this discussion. The upper age limit of the group (19) is well within the age when a considerable proportion of the population attends school. Approximately 35 per cent, or about 1/3,[12] of the total population of the urban districts are children and 2/3 are adults. In other words, there are approximately 2 adults to each child in the urban centers. How does this compare with the rural sections? Over 40 per cent of the people in the rural sections are of this age group (19 or under). This means that out of each 100 people in the rural section, 40 are children and 60 adults, or 1½ adults to each child.

In the city districts there are 2 adults to each child, and in the rural sections only 1½ adults to each child. This one fact alone would give the cities 1/3 more support for each child and probably more difference than that in ability to support schools. This is serious enough, but it is far from the total situation.

The rural sections have 26 per cent of their total population in the old age group, the urban section only 23 per cent. This gives the rural section a larger old age non-producing population.

To make matters even more unequal, the cities have the advantage in the age group of large production, 20 to 44 years. In the rural sections this age group constitutes 33 per cent of the total population. In the cities it is 41 per cent of the total population, a difference from 33 to 41 per cent, or a difference of almost 25 per cent of the rural percentage.

These effects are all more or less cumulative:

1. The rural sections have a much larger percentage of their total population of school age than have the urban sections.
2. The rural sections have a *larger* percentage of old people.
3. The rural sections have a *smaller* percentage of their population in the major productive age group from 20 to 44.

Something of the size of the cumulative effect of these factors in affecting the ability of communities to support schools will be indicated later.

[12] It is slightly more than 1/3. In some states it is less than 1/3. For this reason it is felt no incorrect impression will be given by using 1/3.

*Counties of Indiana.* Analyzing the differences further, the question might well be raised: What would these differences be in smaller units, such as the counties? Table III answers the question, emphatically.

TABLE III.—NUMBER OF ADULTS (OVER 21) TO EACH CHILD (20 AND UNDER) IN COUNTIES OF INDIANA, 1920

| | | | |
|---|---|---|---|
| Brown | 1.066 | Hendricks | 1.501 |
| Martin | 1.093 | Clark | 1.502 |
| Dubois | 1.178 | LaPorte | 1.503 |
| Perry | 1.182 | Madison | 1.526 |
| Adams | 1.190 | Fulton | 1.527 |
| Pike | 1.194 | Huntington | 1.543 |
| Jennings | 1.201 | Vigo | 1.549 |
| Greene | 1.212 | Whitley | 1.559 |
| Jasper | 1.217 | Bartholomew | 1.580 |
| Daviess | 1.219 | Fountain | 1.583 |
| Vermillion | 1.220 | Kosciusko | 1.584 |
| Lawrence | 1.235 | Switzerland | 1.588 |
| Crawford | 1.237 | Putnam | 1.591 |
| Harrison | 1.242 | Howard | 1.600 |
| Sullivan | 1.242 | DeKalb | 1.610 |
| Pulaski | 1.245 | Henry | 1.610 |
| Knox | 1.246 | Randolph | 1.610 |
| Starke | 1.260 | Clinton | 1.616 |
| Monroe | 1.273 | Delaware | 1.626 |
| Scott | 1.303 | Wabash | 1.626 |
| Warrick | 1.303 | Carroll | 1.635 |
| Clay | 1.336 | Elkhart | 1.636 |
| Jackson | 1.338 | Grant | 1.644 |
| Blackford | 1.339 | Fayette | 1.649 |
| Orange | 1.340 | Shelby | 1.649 |
| Spencer | 1.346 | Boone | 1.650 |
| Gibson | 1.356 | Decatur | 1.650 |
| Newton | 1.367 | Dearborn | 1.651 |
| Lake | 1.372 | Allen | 1.654 |
| Benton | 1.390 | Miami | 1.657 |
| Wells | 1.394 | Johnson | 1.664 |
| Washington | 1.397 | Noble | 1.672 |
| Owen | 1.408 | Rush | 1.673 |
| LaGrange | 1.416 | Hamilton | 1.700 |
| White | 1.418 | Floyd | 1.703 |
| Parke | 1.424 | Vanderburgh | 1.724 |
| St. Joseph | 1.425 | Cass | 1.725 |
| Ripley | 1.437 | Montgomery | 1.747 |
| Tipton | 1.454 | Jefferson | 1.770 |
| Marshall | 1.468 | Steuben | 1.770 |
| Jay | 1.469 | Hancock | 1.796 |
| Warren | 1.475 | Tippecanoe | 1.804 |
| Posey | 1.484 | Union | 1.853 |
| Porter | 1.486 | Wayne | 1.888 |
| Franklin | 1.487 | Ohio | 1.901 |
| Morgan | 1.496 | Marion | 1.966 |

The table is to be read as follows: Brown County has 1.066 adults to each child, or approximately as many children as adults. Martin County has 1.093 adults to each child. At the other extreme Marion County has 1.966 adults to each child or approximately twice as many adults as children. Some counties have almost as many children as adults, others have about half as many children as adults. This factor would produce large differences in the ability of the counties to support schools.

As would be expected, the number of adults to each child of school age in the counties varies about as much as the number of adults to each child. Brown is again the low county, having only 1.5 adults to each child of school age while Marion has 2.99.

The counties that have a large urban population have, on the whole, a considerably larger number of adults to each child than have the counties with a large rural population.

A map of the state was constructed showing the number of adults to each child in each county in the state. The counties that had a large number of children to each adult were colored black. The counties with a small number of children to each adult were left white. The distribution of these counties is instructive. Thirteen of the 17 black counties are in the southern part of the state. Two-thirds of the black counties are in a block extending from Sullivan and Greene counties (on the north) to the Ohio River (on the south). The only black counties in the northern half of the state are Pulaski, Jasper, and Adams. The 8 white counties are in the central or eastern part of the state.

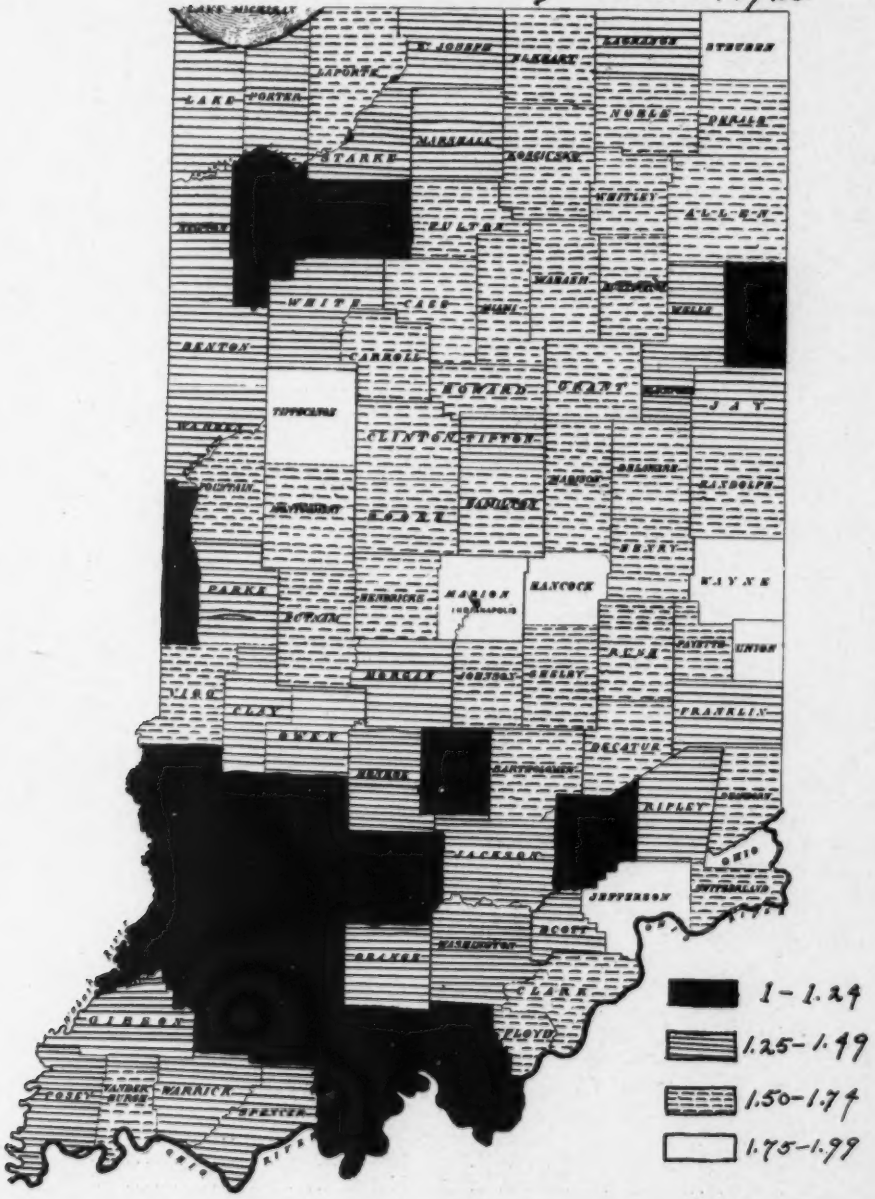
In Cass County, 226 of every 1,000 people are of school age, or slightly more than one-fifth. In Scott County, 332 of every 1,000 people are of school age, or almost exactly one-third. In the first county, 1/5[12] of the population is of school age, 4/5 not of school age; or, there are 4 people of other than school age to 1 of school age. In the second county, 1/3 of the population is of school age, 2/3 of other than school age; or there are 2 people of other than school age to one of school age. It is a fair assumption that, on the average, people out of school age have to support the schools. One county has 4 people out of school age to 1 child of school age, another county has 2 people out of school age to 1 child of school age. Is the county that has 1 adult to each child just as able to support schools for each child as the county that has 2 adults to each child?

The thought is absurd. The county that has twice as many children is only half as able to provide schooling. Another way of looking at it would be that the county is able to provide only half as much schooling for each child.

If some counties sent each child to school only 6 years, they would supply almost as many days of schooling (because of the larger number of children) as other counties would have to supply to send each child to school 12 years.

[12] Approximately. As there are many counties in other states that have even less than 1/5 of the population of school age, it seemed permissible to use 1/5 for purpose of illustration.

Number of Adults (over 21) to Each Child (10 and under) Counties of Indiana. 1920.



*Cities of Indiana.* Is there any difference in the number of children per 1,000 people among the cities of Indiana? The large difference between the urban and rural sections and among the counties would lead us to think so. Table IV gives the facts for the cities.

TABLE IV.—NUMBER OF ADULTS (OVER 21) TO EACH CHILD (UNDER 21), CITIES OF INDIANA, 10,000 POPULATION AND OVER, 1920

| | | | |
|---|---|---|---|
| 1.15 | Whiting | 1.74 | Marion |
| 1.25 | Clinton | 1.77 | Evansville |
| 1.30 | East Chicago | 1.78 | Terre Haute |
| 1.35 | Hammond | 1.78 | Logansport |
| 1.38 | Elwood | 1.80 | Frankfort |
| 1.43 | South Bend | 1.81 | Elkhart |
| 1.45 | Bloomington | 1.82 | Fort Wayne |
| 1.48 | New Castle | 1.82 | New Albany |
| 1.51 | Mishawaka | 1.85 | Jeffersonville |
| 1.52 | Gary | 1.87 | Peru |
| 1.52 | Vincennes | 1.89 | Michigan City |
| 1.67 | LaPorte | 1.90 | Lafayette |
| 1.67 | Kokomo | 1.99 | Richmond |
| 1.68 | Huntington | 2.02 | Indianapolis |
| 1.70 | Anderson | 2.03 | Crawfordsville |
| 1.73 | Muncie | | |

One city, Whiting, has 1.15 adults to each child; two cities, Indianapolis and Crawfordsville, have over 2 adults to each child, with the other cities distributed as shown in the table.

Crawfordsville and Clinton each had between 10,000 and 11,000 inhabitants according to the census of 1920. One has 2,400 children of school age, the other has 3,400. In other words, Crawfordsville could put each child thru high school and then pay for only about as much schooling as Clinton would pay for to put each child thru the grades.

Looking at the problem another way, if Indianapolis had as many children in proportion to population as Bloomington, it would have 17,000 more children of school age. If it had as many children as Clinton, according to population, Indianapolis would have over 28,000 more children of school age than it has. You might well imagine what 28,000 additional children would do to the schools of Indianapolis. Yet that is the burden some Indiana cities are bearing all the time.

The smaller cities show the same general trend as the larger places. If there is any difference the variability of the ratio of adults to children is somewhat larger than in the places above 10,000.

TABLE V.—NUMBER OF ADULTS (OVER 21) TO EACH CHILD (UNDER 21) CITIES OF INDIANA, 2,500 TO 10,000 POPULATION, 1920

| | | | |
|---|---|---|---|
| West Terre Haute | 1.114 | Tell City | 1.299 |
| Garrett | 1.135 | Bedford | 1.325 |
| Bicknell | 1.150 | Nappanee | 1.334 |
| Jasonville | 1.196 | Mitchell | 1.365 |
| Jasper | 1.213 | Linton | 1.388 |

| | | | |
|---|---|---|---|
| Hartford City | 1.393 | Connersville | 1.805 |
| Gas City | 1.395 | Columbus | 1.810 |
| Hobart | 1.457 | Aurora | 1.835 |
| Brazil | 1.478 | Lebanon | 1.868 |
| Alexandria | 1.487 | Goshen | 1.875 |
| Decatur | 1.494 | Plymouth | 1.878 |
| Boonville | 1.506 | Shelbyville | 1.878 |
| Huntington | 1.537 | Valparaiso | 1.894 |
| Washington | 1.541 | Rushville | 1.898 |
| North Vernon | 1.565 | Winchester | 1.899 |
| Sullivan | 1.579 | Kendallville | 1.914 |
| Princeton | 1.580 | Rochester | 1.924 |
| Tipton | 1.617 | Greencastle | 1.932 |
| Portland | 1.618 | Auburn | 1.935 |
| Seymour | 1.628 | Rensselaer | 1.965 |
| Bluffton | 1.660 | Noblesville | 1.973 |
| Dunkirk | 1.682 | Madison | 2.021 |
| Salem | 1.683 | Columbia City | 2.037 |
| Attica | 1.687 | Warsaw | 2.067 |
| Crown Point | 1.688 | Greenfield | 2.110 |
| Martinsville | 1.708 | Franklin | 2.126 |
| Mount Vernon | 1.759 | Union City | 2.130 |
| Rockport | 1.763 | North Manchester | 2.152 |
| Monticello | 1.771 | Greensburg | 2.170 |
| Lawrenceburg | 1.779 | West Lafayette | 2.167 |
| Wabash | 1.798 | Angola | 2.251 |

The facts are available to show which cities have the largest percentage of their children in school. Are they the cities with a large or small proportion of children? It is almost needless to say they are the cities with a small proportion of children. The larger the proportion of children the less chance any one child has of being in school and the shorter the time he will stay in school. This is true even for the ages within the compulsory limit. The correlation between the number of children and the percentage attending school is negative and fairly high. For ages, 16, 17, 18, and 19 it is —.52, —.55, and higher.

## 5. INTERPRETATION OF THE FACTS

The facts show there are great differences in the number of children in communities of the same population. Enough has been said to show that this affects the ability of the communities to supply education for each child. It is evident that this relationship is not a direct one. That is, doubling the number of children reduces by more than one-half the amount of schooling that can be furnished to each child.

Two questions arise:

1. Can this relationship be measured? Is it possible to determine how much doubling the number of children reduces the education that can be provided to each child?

2. If the relationship can be measured, can it be expressed in terms simple enough to be used in surveys and ordinary comparisons that are made of cities?

The facts to be presented indicate that an affirmative answer may be given to each question.

To state the original question again—Does the number of children in a community affect the amount of schooling that can be provided for each child? An actual illustration will be easier to follow than a theoretical one. One of the easier illustrations will be chosen—the effect of doubling the number of children.

Marion[11] County has 2 adults to each child; Brown[11] County has 1 adult to each child. Brown County has twice as many children. The education that 1 child would receive in Marion County has to do for 2 children in Brown County. Because the education has to do for twice as many children, there is only half as much for any one child. This is the first conclusion then: that doubling the number of children leaves only one-half as much schooling for each child. The next step is to see whether it reduces ability to supply education, more than that.

Referring again to a simple illustration, two families with average incomes (about $2,400) will be taken.

| Family A has 2 children | Family B has 4 children |
|---|---|
| 1 - 2 | 1 - 2 - 3 - 4 |

The income of Family A is sufficient to allow a reasonably satisfactory education for the 2 children. The same amount of education has to be divided among 4 children in Family B. Each child will get only half as much. It would indeed be fortunate for the children of Family B if this were the whole situation, but it is not.

Children 3 and 4 of Family B have to be fed and clothed. These living expenses of Children 3 and 4 will use up an amount of money that is equivalent to that which would go for the education of the second child in Family A. This would leave only half as much money in Family B as in Family A to educate twice as many children. The result is *one-fourth* as much schooling for each child.

This is the second conclusion, that doubling the number of children reduces to *one-fourth* the amount of education that can be supplied to each child.

There are some special difficulties in applying the above reasoning to families that do not exist in applying the reasoning to communities. From the standpoint of this discussion it is important to apply it only to cities, counties, and states. After all the objections are raised against it, the evidence seems to show that the reasoning holds for communities.

The above result—that doubling the number of children reduces to one-fourth the amount of schooling that can be supplied to each child—is quite conservative.

[11] Approximately. Even figures are used because the illustration can be followed more easily.

There are several other factors working in the same direction. What are some of these other factors?

Brown County has about 1 adult to each child. Marion County has almost 2 adults to each child. Necessarily, Brown County has a much smaller percentage of her population of the producing ages than Marion County. Brown County has a much larger percentage at the younger or non-producing ages.

In the county that has the small number of children there is a much greater opportunity for savings. This capital would collect rapidly and soon show a very strong cumulative effect. This type of community would not only have its ordinary income but the income from the accumulated capital. This added to the ordinary income would soon make the income very much larger than the income in the community with the large number of children. This accumulated capital would show not only in increased income from investment, but, more important, in improved machinery and other means of creating wealth.

As long as education was a small factor in the total expenses of a people, this factor of savings was not important. As soon as the cost of education in either community becomes large in relation to savings, this factor assumes a serious aspect. If the cost of education in each community is small in relation to savings, the education of the additional children in the community having the large number of children could be paid from what would otherwise go into savings. The information in regard to savings and income is not reliable enough to justify dogmatic statements. But the information seems to be sufficient to say that there are many communities in Indiana where satisfactory education for the additional children could not be paid for from savings or in any other manner by the community, the result being that the education that can be provided will have to be divided among more children, each child getting less.

Another factor would soon become of great importance in producing differences between the two types of communities. The community with the smaller number of children would be able to supply better education and training. This would tend to increase the efficiency and wealth of one community faster than that of the other community. The effect of this factor would become cumulative and of great force in a period of years.

The original assumption was that ability to support schools and the number of children in a community did not vary as a direct relationship. If the number of children in a community is doubled, the community is not able to provide even one-half as much education for each child.

Some of the reasons for this more rapid decrease are not only that the education has to be divided among more children but also:

(1) That the additional children have to be fed and clothed.
(2) That a larger percentage of children makes a larger percentage of non-producing people.
(3) That a larger percentage of children makes a smaller percentage of people in the most productive ages.

(4) That in a community having a small number of children, savings will be larger, and this will soon have a cumulative effect.
(5) That the better training provided will increase efficiency and production and have a large cumulative effect.

How much difference will all the factors make?

In the illustration concerning Family A and Family B it was decided that doubling the number of children reduced to one-fourth the amount of education for each child. The evidence seems to show that the conclusion is even more sound concerning communities.

This is really the essence of the formula—that beginning with a reasonable number of children, doubling that number reduces to one-fourth the amount of education that can be supplied for each child. That this is an under- rather than an over-statement of the conditions should be clear from the fact that only the first of the list of causes given above is necessary to produce that result.

## 6. FORMULA

| Community A has 2 adults to each child | Community B has 1 adult to each child |
|---|---|

Community B has twice as many children as Community A to each adult. But Community B is only one-fourth as able to supply education or is able to supply each child with only one-fourth as much education. Doubling the number of children to each adult has reduced to one-fourth the ability to support schools.

Therefore, the relationship is not direct but is represented more nearly by the square of the numbers. Two (2) squared equals 4. One (1) squared equals 1. The relation of the ability of Community A and B to support education is represented by the square of the numbers or 4 to 1. This seems to be a very fair statement of the fundamental law underlying the relationship.

The ratio of 2 adults to 1 child will be taken as the standard ratio. Each community will be compared to or measured by this.

Two (2) squared or 4 is the standard.

Three cases will illustrate the procedure.

*Case I.* Gary has 1.5[15] adults to each child. The 1.5 squared equals 2.25. This 2.25 is to be compared with 4 as the standard. Gary is 2.25 of 4 or $\frac{2.25}{4}$ of the standard.

*Case II.* Indianapolis has 2 adults to each child. The 2 squared equals 4. This 4 is to be compared with 4 as the standard. Indianapolis is 4 to 4 (or 4/4) or standard as far as this factor affects ability to support schools.

[15] Approximately.

*Case III.* City Y has 3 adults to each child. The 3 squared is 9, which should be compared to the standard 4. This gives City Y $\frac{9}{4}$ or 2¼ standard ability units. In other words, it has 2¼ times the ability to support schools of the standard city.

Let X stand for the ratio of adults to children, or the number of adults to each child.

The formula is $\frac{X^2}{4}$.

The steps in its computation:

1. Obtain the number of adults to each child in the community that is being studied.
2. The "standard" ratio of adults to children is $\frac{2}{1}$.
3. Because the square of the number is a better indication of the manner in which differences in population affect ability to support schools, the 2 is squared, making 4.
4. Four (4) becomes the unit of comparison or measurement, i.e., the S.A.U. or Standard Ability Unit.
5. The ratio obtained in step one is squared and compared with 4.
6. The effect of the ratio of adults to children upon ability to support schools is measured by comparison with this Standard Ability Unit.

The validity of this formula is not affected by difference in wealth. If communities differ in wealth, the per capita wealth can be multiplied by the results from this formula to get a composite measure of ability to support schools.

## 7. DEFENSE OF THE FORMULA

The question immediately arises about the formula, Why do we take the ratio of 2 adults to 1 child as the standard? The attempt from the very beginning was to find a starting-point that would be rather fundamental and therefore stable. Too many of our measurements in the social sciences start with the average of the group as the point from which to make comparisons and deductions. The progress will never be made that should be made until beginning points more or less independent of the groups are located.

The ratio of adults to children in the average state or community might have been taken as the standard. This average would be constantly shifting so that it would not be satisfactory. A much more logical ratio is that relation between adults and children in a stable population.[16] The ratio of children to adults in a stable population is the theoretically desirable ratio to maintain at least after an optimum population has been reached. In the long run any community or state that goes much beyond this ratio does so by means of special effort.

[16] It is not meant to imply that this ratio might not change in a stable population due to a lower death rate or other causes.

Either that community will have to make a greater effort to supply education, or, what is more probable, less education will be provided for each child. The formula is based, therefore, on the ratio of adults to children in a stable population.[17] By stable population is meant one unaffected by immigration and emigration, where births equal the deaths.

In trying to determine the ratio of adults to children the question arises, At which age does one become an adult? The age chosen would affect the ratio, but as it would affect it about equally in different communities, it would make little difference in the results from the formula. The first thought was to use 16 as the age limit, as that corresponded roughly to the compulsory school age limit. Further investigation showed that if the formula was going to be used in the future a higher age limit might just as well be chosen. It is true only a small part of the people 17, 18, and 19 years old are in school. In the future a larger proportion probably will be. In a stable population when the proportion of children would be much less than it is today in most places, the number of children at these higher ages in school would probably be greatly increased. Considering the age at which the most accurate figures would probably be available and for other reasons 20 was finally chosen as the dividing-point between children and adults.

A very important question arises, What will be the ratio of adults to children if 20 is taken as the dividing-line between the two? It is not an easy problem to determine what the age distribution would be in a stable population. After considering all the factors involved, it seems very much better to accept some of the estimates that have been made rather than attempt to calculate the age distribution in a stable population. Professor J. W. Glover,[18] in a document published by the Bureau of the Census, gives the number of people who would be living at each age from 100,000 births. Calculations show that almost exactly two-thirds of the people in a stable population would be 21 years of age or over. This is the reason for taking a ratio of 2 adults to 1 child as the standard ratio. A ratio of 2 adults[19] to 1 child is the ratio in a stable population. As pointed out before, it is a relatively stable ratio, which is an important point in its favor.

The above facts are the explanation for using a ratio of 2 adults to 1 child as a standard in the formula. The evidence shows that if those 20 and under are called children, the ratio of adults to children is for all practical purposes near enough to 2 to 1 to be called that.

The formula might be ever so satisfactory but unless reliable figures for the basic data could be obtained the formula would be of little value. For that reason it will be necessary to determine the reliability of the basic data before discussing the use of the formula.

[17] A very slight rate of increase was at first allowed for, but it made too complicated a formula.

[18] Glover, J. W. *United States Life Tables.* Published by the Bureau of the Census.

[19] To be exactly 2 to 1, the age limit would have to be slightly less than 21. The difference would not affect the formula.

## 8. RELIABILITY OF THE BASIC DATA

Before any great reliance could be placed upon results from the study, something should be known of the reliability of the data. It would be highly desirable to know the probable error of the figures and how the probable error compares with the differences on which the conclusions are based. There would be no point in drawing conclusions from a difference of 10 per cent if the figures might be in error by 10 per cent. Fortunately, the errors are very much smaller than 10 per cent and the differences are very much larger than 10 per cent.

The difference between the total number of people of school age reported by the Federal Census (1920) and the number reported by the school enumeration is less than 2 per cent and probably very much less. The adjusted census figure gives 796,754 people 6 to 20 years of age. The school enumeration gives 784,430 people 6 to 20 years of age. The two enumerations were made at different times of the year with different instruction and yet give remarkably similar results. The Federal Census is consistently larger as it includes everyone of the age group. The school enumeration excludes a good many individuals of the 6 to 20 age group, as is seen from the following instructions:

Instructions to people taking the school enumeration:

(*a*) "Do not enumerate married people."

(*b*) "Do not enumerate persons who are only temporary residents of your corporation."

(*c*) "Do not enumerate children attending school in your corporation whose parents or guardian reside elsewhere."

The Federal Census instructions were to include everyone. It is rather remarkable that the difference between the adjusted Federal Census figures and the school enumeration is no larger than 12,324.

It is necessary to explain the meaning of the "adjusted" Federal Census figures as it is the figure quoted above. The "adjusted" figure is the census figure after certain changes have been made partially allowing for the differences in instruction under which the two counts were made. Obviously, if the school enumeration excludes all married people under 21 and the Federal Census includes them, an adjustment should be made before the figures are compared.

The school enumeration includes children from 6 to 21, with certain exceptions. From the Federal Census figures available, the closest approximation that could be made to this was 5 to 21. The 5- and 6-year-old children were reported together in the Federal Census as being 116,094. It is certainly a fair assumption that not more than 58,000 (or half) of these are 6 years of age. Adding 58,000 (for the 6-year-old) to the number from 7 to 21 in the Federal Census gives 803,281, or the number from 6 to 21 years of age.

The school enumeration excludes married people. Certainly the number married should be deducted from the Federal Census before it is compared with the school enumeration. The Census reports the married people from 15 to 19 and from 20 to 24. This makes it very difficult to obtain the number of married people under 21, the number that would be excluded from the school census. According to the Census

there were 2,864 married people from 15 to 19 years of age. There were 33,768 married people from 20 to 24. The total for the 15 to 24 age group is 36,632. As the age 20 is between these two age groups, is it fair to assume that an average of the two periods would be a conservative estimate of the number of 20-year-olds who are married? This average is 3,663, the number of married people 20 years old. Adding 3,663 to 2,864 (married from 15 to 19) makes 6,527 married people of school age.

Subtracting 6,527 from 803,281 (Census figures 6 to 21) leaves 796,754, the number of unmarried people between 6 and 21 according to the Federal Census. The state school enumeration was 784,430, being only 12,324 less than the census figures. When it is remembered that there was about three months' difference in the dates at which the counts were made and several other differences in instruction that cannot be allowed for, it is surprising that the figures are so nearly the same. This is highly satisfactory evidence that the figures are more than sufficiently accurate considering the purposes for which they are to be used.

## 9. USE OF THE FORMULA

The real test of the formula is in using it. If the formula is fairly sound theoretically and the figures are reliable, the next step is to try the formula.

An illustration will be given involving three Indiana cities. The illustration will show how to use the formula and how to combine wealth and the ratio of adults to children to obtain a composite measure of ability to supply education for each child.

The formula is $\frac{X^2}{4}$.

X is the number of adults to each child.
The illustration follows:

| | (1) Per Capita Wealth[20] | (2) Number of Adults to Each Child $X$ | (3) Ratio Squared $X^2$ | (4) Ratio Squared Divided by 4 $\frac{X^2}{4}$ | (5) Standard Ability Column 1 Multiplied by Column 4 |
|---|---|---|---|---|---|
| Indianapolis | $1,913 77 | 2.02 | 4.08 | 1.02 | 1,954.04 |
| Gary | 2,272 26 | 1.52 | 2.31 | .577 | 1,311.02 |
| South Bend | 1,824 06 | 1.43 | 2.04 | .51 | 930.27 |

[20] Taken from *Financial Statistics of Cities*, 1921.

The first column gives the per capita wealth of each of the three cities. The second column gives the number of adults to each child. This number is squared in Column 3. The number, after it is squared, is divided by 4 in Column 4. The reason for dividing by 4 is explained under the previous discussion of the formula. To obtain Column 5, multiply Column 1 by Column 4. The resulting value in Column 5 is the ability of the city to supply education for each child, as determined by a combination of the wealth of the city and the number of children to be educated.

If the 3 cities were compared in regard to their ability to supply education for each child, on the basis of wealth Gary would stand first, Indianapolis second, and South Bend last. If the cities were compared on the basis of the number of adults to each child, Indianapolis would be first, Gary second, and South Bend last. However, a much truer picture of ability to support schools is given by combining the two factors, obtaining the Standard Ability.[21] On this combined basis Indianapolis is far more able to provide schools than either of the other cities, and Gary is much more able than South Bend.

The following table applies the formula to each of the counties of Indiana. The ratio of adults to children in each county, which is given in Table III, p. 13, is squared and divided by 4. This gives the Standard Ability[21] as determined by population. The per capita wealth of each county as shown by the map on page 27 is multiplied by the result from the above process. The values given in Table VI result.

TABLE VI.—STANDARD ABILITY OF COUNTIES OF INDIANA AS DETERMINED BY COMBINING THE RATIO OF ADULTS TO CHILDREN WITH PER CAPITA WEALTH

| | | | |
|---|---|---|---|
| Brown | 168.33 | Floyd | 582.87 |
| Crawford | 201.00 | Washington | 583.14 |
| Martin | 208.37 | Ripley | 603.53 |
| Perry | 223.79 | Clark | 605.33 |
| Harrison | 244.62 | Vermillion | 627.55 |
| Dubois | 313.28 | Knox | 646.69 |
| Lawrence | 335.20 | Jackson | 668.78 |
| Pike | 355.32 | Owen | 684.78 |
| Greene | 420.86 | Jefferson | 721.31 |
| Monroe | 425.51 | Gibson | 739.19 |
| Orange | 432.13 | Vigo | 808.25 |
| Warrick | 485.19 | Morgan | 839.61 |
| Daviess | 487.55 | Dearborn | 842.93 |
| Jennings | 495.97 | Adams | 847.68 |
| Clay | 496.90 | Franklin | 886.15 |
| Spencer | 517.04 | Parke | 903.16 |
| Scott | 547.29 | Madison | 925.37 |
| Sullivan | 548.00 | Blackford | 928.03 |
| Switzerland | 563.28 | Pulaski | 981.58 |

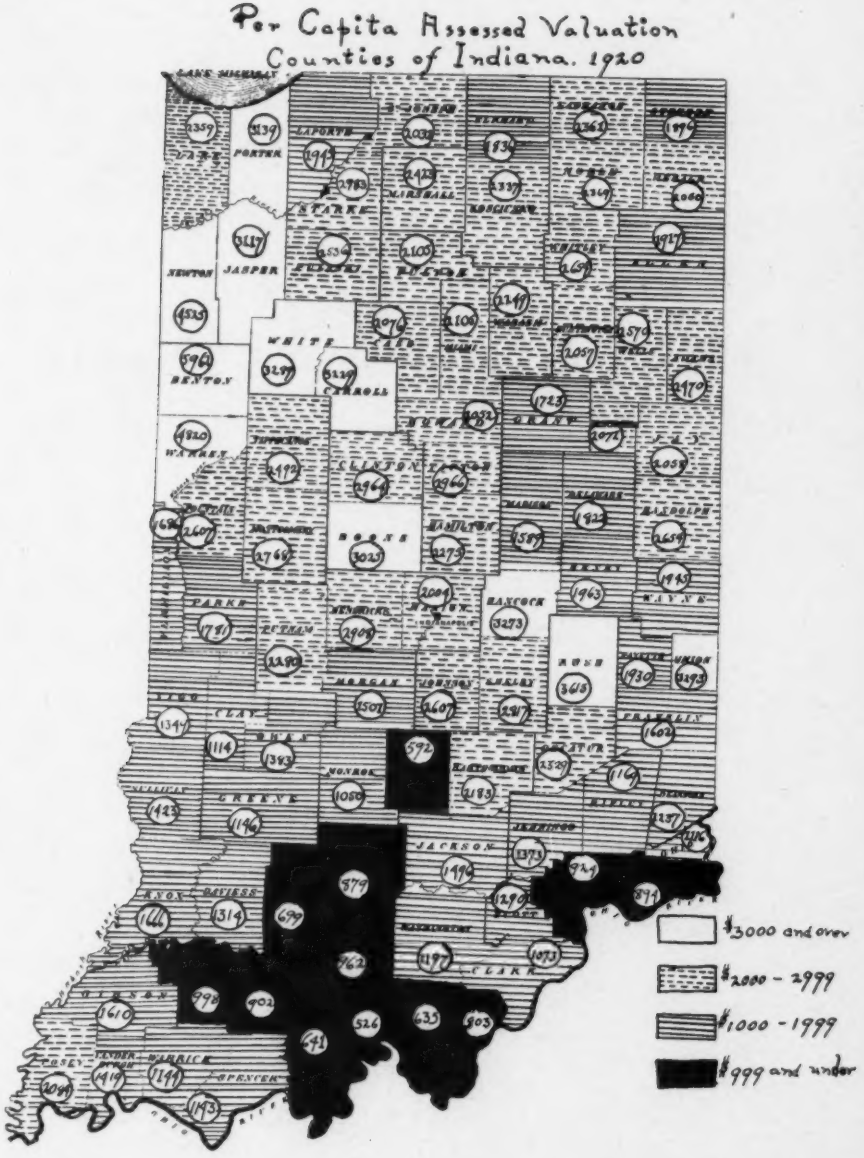
[21] A standard ability might be determined involving any number of factors. In this discussion the primary consideration is given to a Standard Ability depending upon the population factor. An indication is given of how this may be combined with wealth.

| | | | |
|---|---|---|---|
| Ohio | 1,008.57 | Cass | 1,544.84 |
| St. Joseph | 1,031.91 | Tipton | 1,566.11 |
| Vanderburgh | 1,055.00 | Decatur | 1,584.05 |
| LaPorte | 1,099.35 | Whitley | 1,624.58 |
| Starke | 1,104.95 | Fountain | 1,632.09 |
| Lake | 1,109.09 | Hendricks | 1,637.57 |
| Jay | 1,109.55 | Hamilton | 1,642.98 |
| Posey | 1,148.32 | White | 1,651.13 |
| Jasper | 1,153.41 | Noble | 1,656.27 |
| Grant | 1,163.31 | Kosciusko | 1,699.62 |
| LaGrange | 1,183.20 | Randolph | 1,720.15 |
| Delaware | 1,204.59 | Porter | 1,732.76 |
| Huntington | 1,222.29 | Wayne | 1,733.31 |
| Fulton | 1,227.76 | Johnson | 1,804.54 |
| Elkhart | 1,228.46 | Shelby | 1,913.16 |
| Wells | 1,246.80 | Clinton | 1,932.80 |
| Henry | 1,272.16 | Marion | 1,935.91 |
| Marshall | 1,306.52 | Tippecanoe | 2,026.34 |
| Fayette | 1,310.95 | Boone | 2,057.43 |
| Allen | 1,311.56 | Montgomery | 2,112.53 |
| Howard | 1,313.53 | Newton | 2,113.31 |
| DeKalb | 1,328.47 | Carroll | 2,157.37 |
| Bartholomew | 1,362.41 | Rush | 2,526.90 |
| Putnam | 1,443.57 | Warren | 2,622.29 |
| Miami | 1,444.53 | Hancock | 2,638.42 |
| Steuben | 1,479.00 | Union | 2,825.66 |
| Wabash | 1,487.20 | Benton | 2,879.71 |

## 10. CONCLUSIONS

The previous discussion has pointed out:

1. That there are large differences among communities in the number of children per 1,000 people, and that these differences have very important effects upon ability to support schools.
2. That the relationship between the number of children and ability to support schools is not a direct negative relationship, but that with an increased number of children ability decreases more rapidly than the number of children increases.
3. That the relationship between the number of children and ability to support schools can be measured and that the formula presented $\frac{(X^2)}{(4)}$ involving the square of the number of adults to each child and compared to the standard is a fairly satisfactory measure of the effect of population upon ability to support schools.
4. That while the formula is not a complete index of ability to support schools, by means of it two very important factors determining such ability, wealth and the number of adults to each child, can be combined. The two factors combined are superior to either of the factors taken alone. The formula is an important step in the


Per Capita Assessed Valuation
Counties of Indiana. 1920
$3000 and over
$2000 - 2999
$1000 - 1999
$999 and under

construction of a complete index of ability to support schools. What is needed now is to have these two factors combined with others to make a complete index that would measure the ability of any community to furnish education to each child. For use in school surveys the formula would be better than the methods that have been used to compare the ability of communities to support schools. The formula as given may be applied to any school district. It may be used to compare the ability of states or any smaller district. Summing up all the evidence shows that the formula in connection with per capita wealth may be used as a far better measure than anything else that is available, of the ability of a community to furnish education for each child.

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